Cool Pavements at a Time of Program Transition

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EPA Workshop on Cool Pavements: Developing Research and Implementation Strategies

by

Michael Markow, Robert Hyman, and Louis Lambert
Cambridge Systematics, Inc.

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Transportation leadership you can trust.

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Introduction

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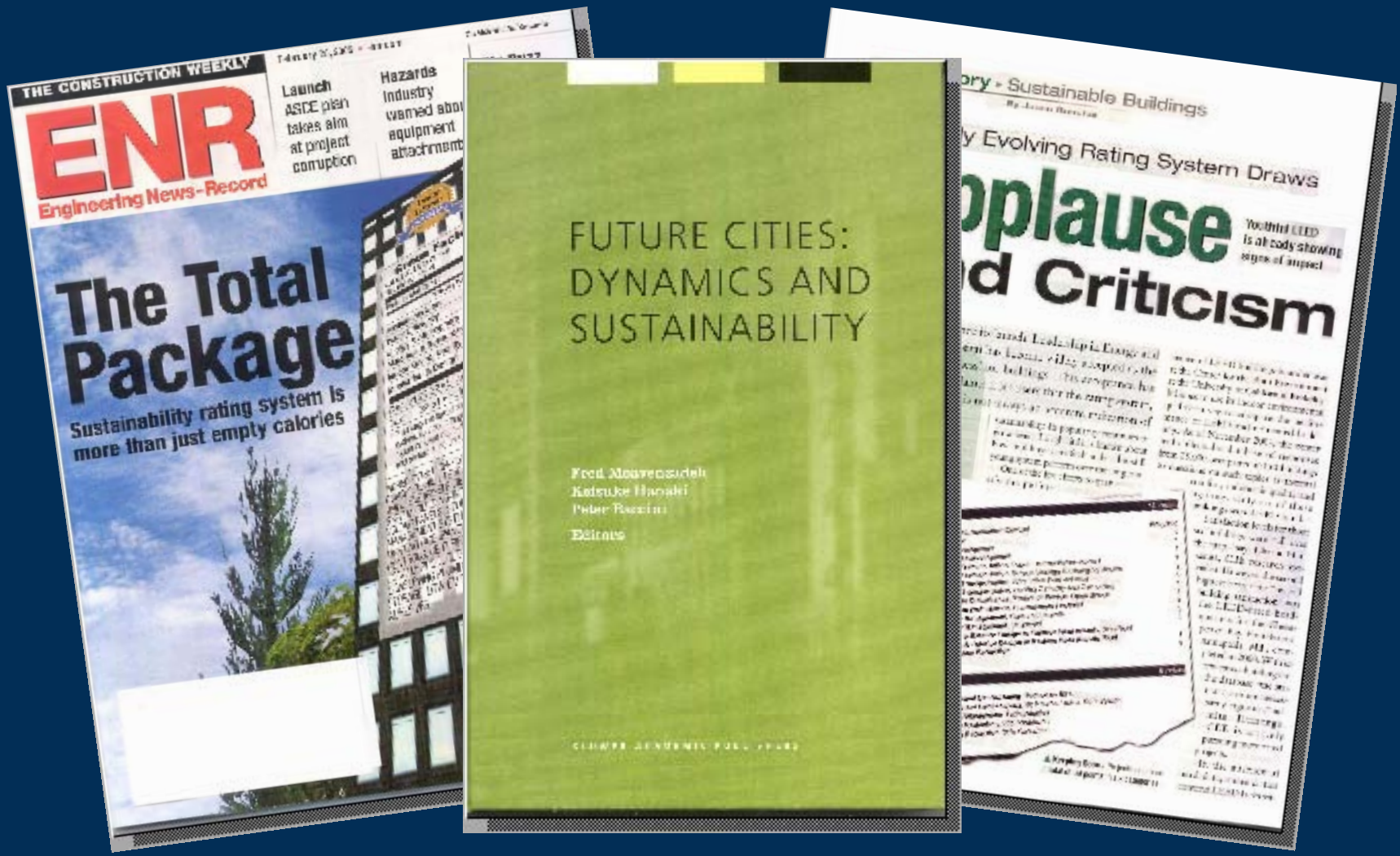
Introduction, continued



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Introduction, continued

- **Implications**
  - **Effects of built environment on heat island reduction entering the mainstream in U.S. buildings market**
  - **Transportation impacts on heat island becoming an issue in megacities worldwide**
  - **Sustainability driving both trends**
  - **Cool pavements are one element of sustainable transportation policies**
  - **How to "transition" cool pavements toward wider understanding, acceptance, and implementation in the U.S.?**

Technological Options for Cool Pavements

- **Practical options using today's technology**
  - **PCC surface (conventional, UTW, RCC)**
  - **Porous pavements (both asphalt and concrete)**
  - **Composite pavement (asphalt over concrete) with rubberized asphalt surface (Phoenix)**
  - **Light-colored chip seals**
  - **Colored asphalt binders (if additional cost is warranted)**
  - **Unbound materials (e.g., grass, rock, gravel, reinforcing grid – as used in parking areas)**

Study by Cambridge Systematics, Inc.

Objectives

- Review technical work to date
- Interview industry representatives
  - Factors underlying decisions on pavement type
  - Perceptions of cool paving techniques
- Prepare document for EPA

Local agencies contacted

- Phoenix, Tucson, AZ
- District of Columbia
- City of Chicago, IL
- Houston, TX
- Wayne County, Macomb County, MI
- Winston-Salem, NC
- Atlanta Cool Communities

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Study by Cambridge Systematics, continued

State DOTs contacted

- North Carolina
- Georgia
- Arizona
- Illinois District 1
- Michigan Metro Region Office

Private Sector Developers, Owners contacted

- Parking Company of America (Atlanta)
- Ford Motor Company – Rouge Industrial Revitalization Project ("green" manufacturing plant)
- Information on major parking areas for several manufacturing plants and maritime ports

Study by Cambridge Systematics, continued

Pavement industry vendors, technical associations, researchers, contractors contacted

- Several representatives of portland cement concrete industry
  - American Concrete Paving Association (ACPA)
  - Portland Cement Association (PCA)
  - Southeast Section, ACPA; Michigan CPA
- Several representatives of asphalt paving industry
  - National Asphalt Paving Association (NAPA)
  - Michigan Asphalt Paving Association; Houston contractor
- Research community
  - Houston Advanced Research Center (HARC)
  - Arizona State University (ASU)
  - Many associated Web sites, technical reports, papers

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Pavement Industry

Broadly defined

Materials availability and cost very important to industry

Key players

- **Owners – public agencies and private commercial firms**
- **Engineering – designers, inspectors, testing labs**
- **Contractors – asphalt, concrete, or both**
- **Vendors and suppliers – cement, aggregate (gravel, crushed rock), other products**

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Pavement Industry, continued

Key players, continued

- Professional and trade associations
  - Often represent individual groups, products, or practices
  - Membership services – technical support, research, dissemination of information, political advocacy
  - Provide a linkage between local member concerns and national perspectives and positions

Bottom line:

- While industry sectors and groups share basic interests and concerns…
- … the pavement industry in the U.S. represents diverse interests and positions on specific issues

Paved Facility Owners

Public sector

- State departments of transportation (DOTs)
- Counties and cities

Quasi-public

- Toll road authorities
- Port and airport agencies (if not municipal)

Private sector

- Subdivision and commercial developers
- Commercial plant and facility owners (e.g. parking areas)

Typical State DOT

Strong technical and analytic capabilities

- Periodic data collection and analysis
- Pavement management systems, historical data
- Life-cycle cost analyses, preventive maintenance strategies
- Periodic data collection and analysis
- Laboratory testing, field inspections
- LTAP – Local Technical Assistance Program

Access to federal assistance

- Program funding
- FHWA division offices: information, technology transfer

Local Agencies

Capabilities and practices vary

- Some have pavement management systems and analytic capabilities (local or regional level; DOT may assist)
- More typically, decisions based on standardized practices guided by historical precedents

Decision criteria

- Agencies may understand long-term cost-effectiveness
- However, limited funding
  - may not provide long-term incentive
  - may encourage “worst-first” strategies (not preventive actions)
  - may encourage maximizing miles paved

Local Agencies, continued

Factors often considered in pavement selection

- **Initial pavement cost (as opposed to life-cycle cost)**
- **Potential improvement in condition**
- **Importance of street or road**
- **Political considerations**
- **In certain cases, subjective perceptions of appearance**

Metropolitan Planning Organizations (MPOs)

MPOs can help promote cool pavements

- MPOs have the interest and capability:
  - Have transportation and environmental expertise
  - Required to consider environmental consequences of proposed transportation improvements
- MPOs have the responsibility:
  - Projects in the federally mandated metropolitan area TIP and Long Range Plan must meet federal air quality guidelines to get federal funds
  - Required to verify that these plans conform to state air quality plans
- MPOs have the access:
  - MPOs are federally mandated organizations
  - Routinely work with state DOTs and local agencies

Private Owners and Developers

Difficult to generalize across all commercial owners and regions

Interviews with select group suggest several pavement selection criteria, but other positions are possible

- **Initial cost is paramount if not likely to retain ownership**
- **Performance also considered if ownership is long-term**
- **Will respond to regulatory requirements – but again, cost will also drive decisions**
- **May prefer regional consistency in regulation to local variations in requirements**
- **Subjective judgments may also influence selection**

Private Owners and Developers, continued

Major facilities more likely to be analyzed for engineering and technology options, performance, and life-cycle cost

- **Parking lots at major manufacturing plants**
- **Maritime port terminals (cargo container holding and transshipment)**

Environmental Considerations in Current Pavement Decisions

Environmental factors addressed in road projects:

- During project planning, development, design, and construction planning
- Typically not in choice of pavement type
- Focus today on NPDES regulations
  - Storm water management
  - Particulate control
- Pavements:
  - Stand-alone bid component
  - Not affected by other project work

BUT – Local governments and private sector ARE interested in new solutions to environmental problems

Transitioning to Wider Consideration of Environmental Benefits of Cool Pavements

Good information dissemination
+ clearer understanding of performance, costs and benefits
= keys to wider recognition, acceptance, and use

Key impediments to overcome:

- **Many stakeholders interviewed had not heard of idea**
- **Web sites are silent on subject (other topics -- AQ, ground water, noise, visual – well covered)**
- **Role of cool pavements needs to be better understood**
  - **given multiple sources of urban heat and complex urban setting**
  - **within spectrum of heat-island-reduction strategies**
- **Results of theoretical and empirical studies need to be packaged for easier understanding and use**

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Avoid the Chicken & Egg Problem…

"We need to understand costs and benefits before building cool pavements"

"We need to build cool pavements to understand their costs and benefits"

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Potential Approaches to Implementation

Encourage / build on cool pavement research and use in regions already active in field

- **Roads, streets, highways; parking areas (public, private)**
- **Other facilities (e.g., air or maritime ports; athletic facilities)**

Consider cool pavement strategies and their additional benefits on projects already qualified for other objectives

- **Stormwater management, groundwater quality**
- **Congestion mitigation, air quality**
- **Safety; noise reduction**
- **Aesthetics, streetscapes, and context-sensitive design**

Research Needs

Practical technical guidelines

- "Cool pavement" techniques and mechanisms in terms that pavement practitioners understand
  - Solve heat-transfer equations for basic pavement configurations and geographic conditions
  - Support with empirical data, demonstration project results
  - "Managing heat island reduction" – net contributions of different pavement configurations through full 24-hr heating and cooling cycle

Field tests and case studies

- Site tests to document initial and long-term "cool" performance
- Case studies of porous pavement behavior as a cool pavement

Research Needs, continued

Institutional capacity-building

- Develop and disseminate “success stories” from markets where cool pavements are being used now
  - Identify factors that motivate local decision-makers
  - Develop “tool boxes” of technical, performance, and cost data to guide others
  - COMMUNICATION of benefits and case study successes!
- Build a cool pavement rationale to gain industry acceptance
  - Conduct research and demonstration projects under realistic field conditions – engage a consortium of interests
  - Document the corollary benefits of greater use of cool pavement techniques on projects meeting other objectives
  - Build partnerships among EPA, FHWA, AASHTO, agencies at state, regional, and local levels, TRB, and NCHRP

Conclusions

Cool pavements are not the complete answer to urban heat islands, but they may have a *useful role to play*

There are *no magic bullets* – cool pavements will likely be addressed with existing techniques and materials

Strategies should *accommodate industry diversity*

- **Pavement industry has many actors**
- **All share a demonstrated commitment to environmental quality**
- **However, specific interests, market strengths, and business decision criteria vary among them across the country**

Conclusions, continued

Viewing cool pavements as an *added benefit of projects serving other objectives cost-effectively* is way to go for now

Strategies for research and implementation will require *teamwork*

- **Local consortia of public and private interests (e.g., Phoenix)**
- **Partnerships among agencies in the policy, funding, and implementation network**
  - **Local agencies, MPOs, other regional agencies**
  - **EPA, FHWA, AASHTO, TRB, NCHRP**

Conclusions, continued

A Communications Strategy or Plan for Cool Pavements is a critical "transition" element

- **There is now *no environmental process* to plug into regarding pavement type selection or design**
- **Agencies and commercial firms may be reluctant to assume cost and risk of changing current pavement practice without *better information on performance and benefits***
- **Nonetheless, public and private firms are *willing to consider* improving environmental quality**
- ***Better information, better dissemination, and documented success stories* are key to gaining greater recognition and acceptance of cool paving techniques**
- ***A lot can be done* here without mandates, rules, major additional funding**